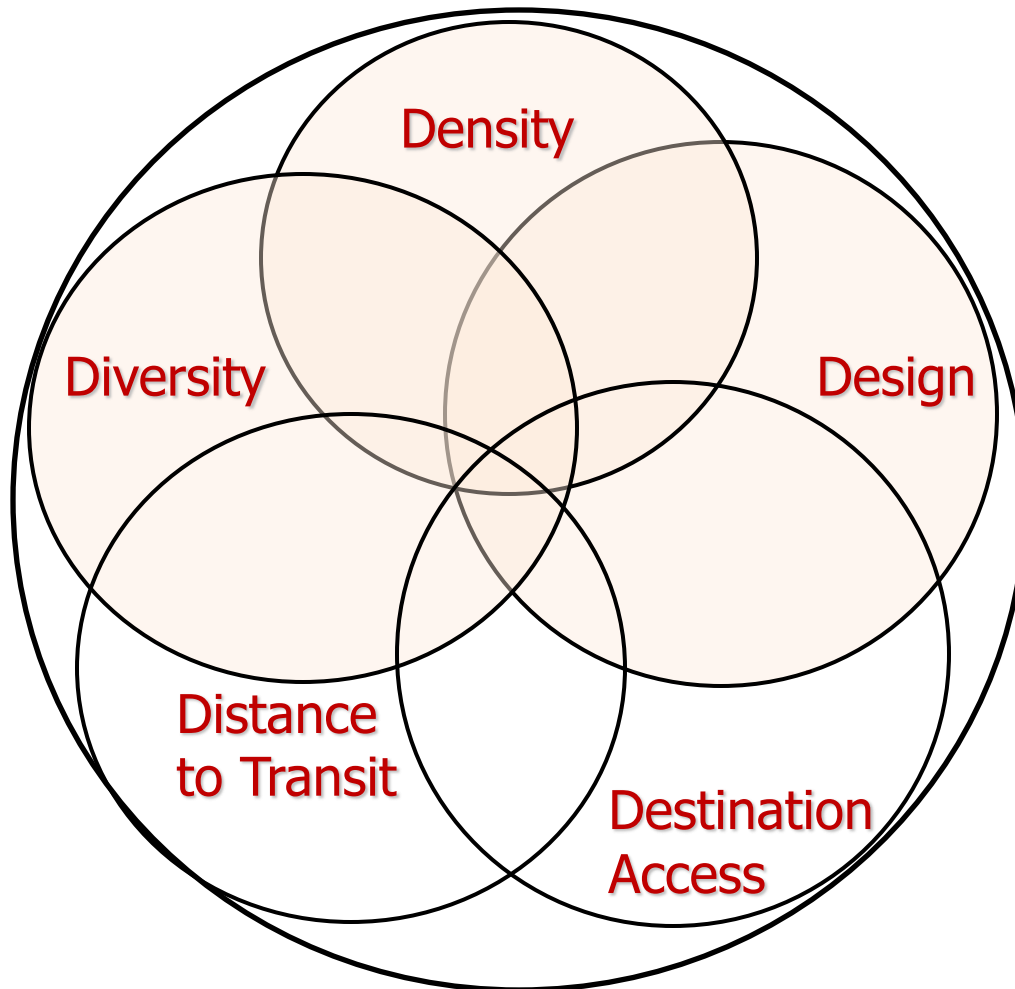


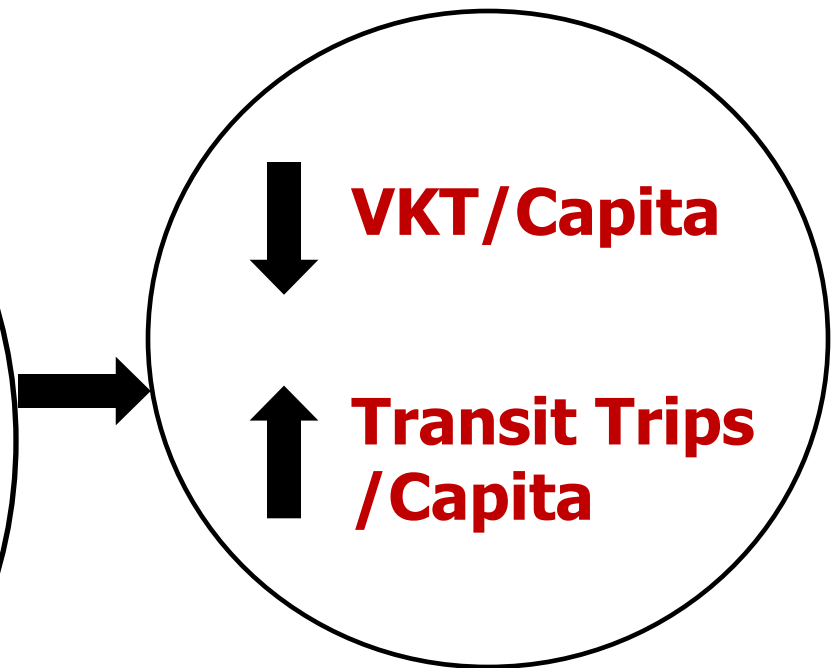
Urban Planning & Sustainable Mobility

Robert Cervero, UC Berkeley

5D's of the Built Environment



Impacts



R. Cervero & K. Kockelman, *Travel Demand and the 3Ds: Density, Diversity, Design*, *Transportation Research*, 1996;
R. Ewing & R. Cervero, *Built Environment and Travel*, *TRR*, 2001; *JAPA*, 2010

Meta-Evidence on 5Ds & VKT in US

Vehicle Kilometers Traveled (VKT)

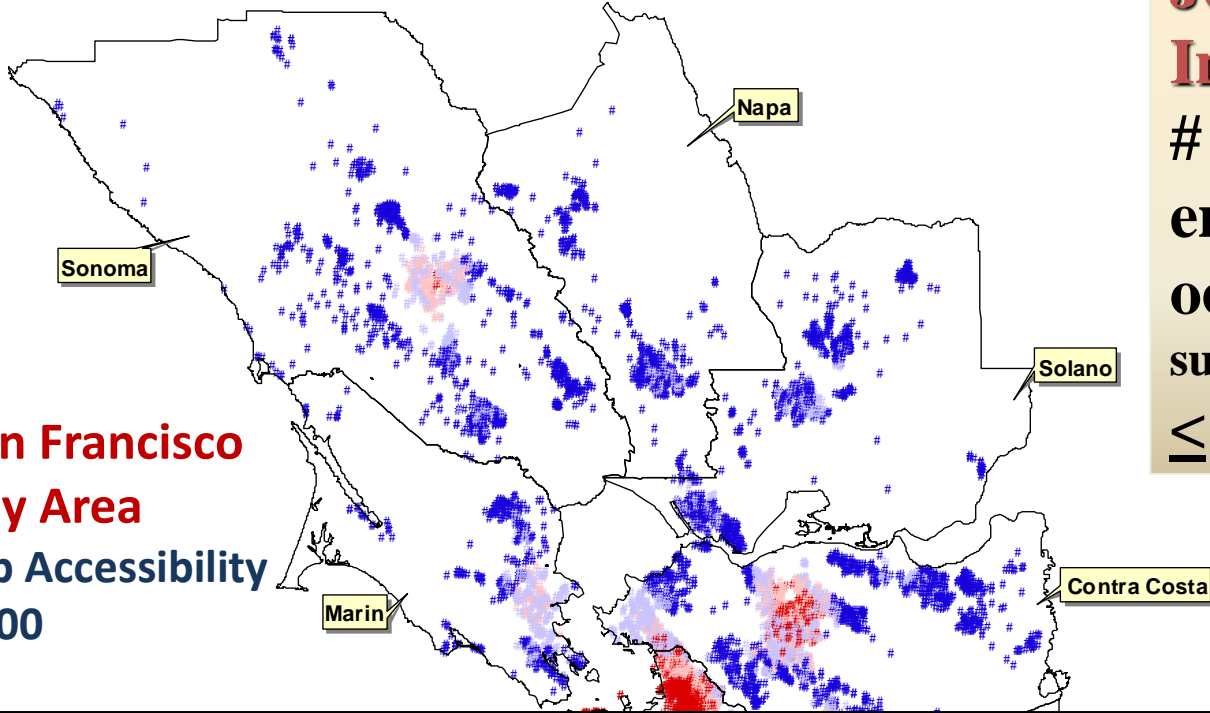
Elasticities from Regressions & Logits

Category	Urban Form Description	Elasticity for Change in VMT
Density	Household/Population Density	-0.04
Diversity	Land Use Mix (entropy)	-0.09
Design	Intersection/Street Density	-0.12
Destination Accessibility	Job Accessibility By Auto	-0.20
Distance to Transit	Distance to Nearest Transit Stop	-0.05

Source: R. Ewing & R. Cervero, Travel and the Built Environment: A Synthesis, *Transportation Research Record* 1780, 2001; Confirmed in Ewing & Cervero, *Journal of the American Planning Association* 2010.

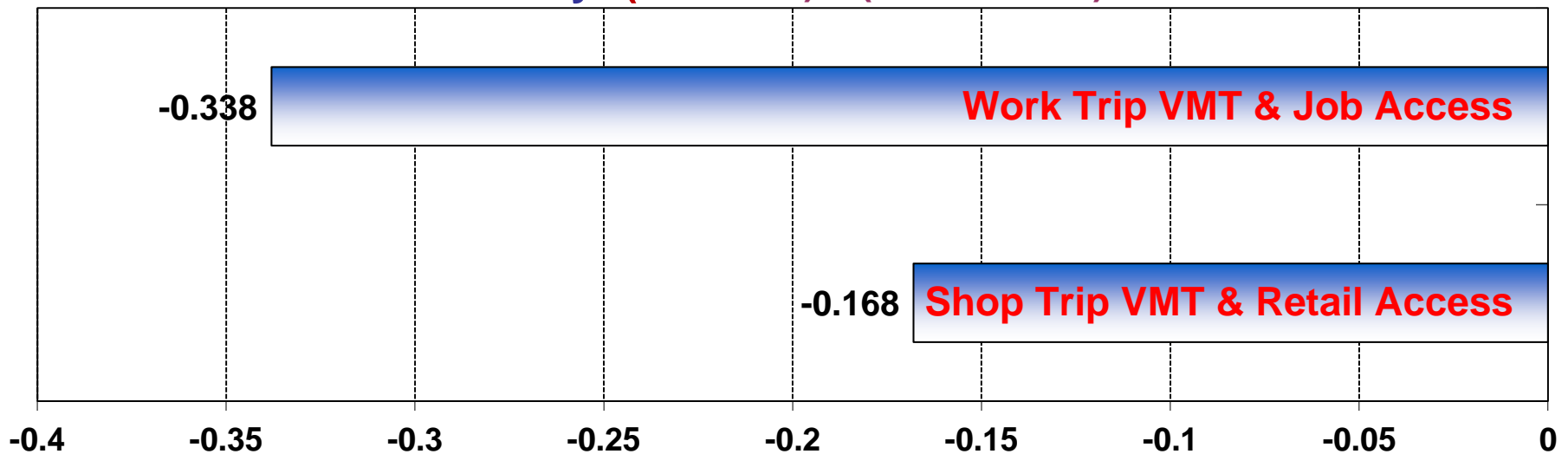
Elasticity = (% Δ VKT) / (% Δ in “D” Variable)

**San Francisco
Bay Area
Job Accessibility
2000**



**Jobs Accessibility
Index (OM) =**
**# of jobs in
employed-resident's
occupation (exec/prof;
support/service; blue collar)**
≤ 4 miles

Elasticity: $(\% \Delta \text{VKT}) / (\% \Delta \text{Access})$



Balanced Growth

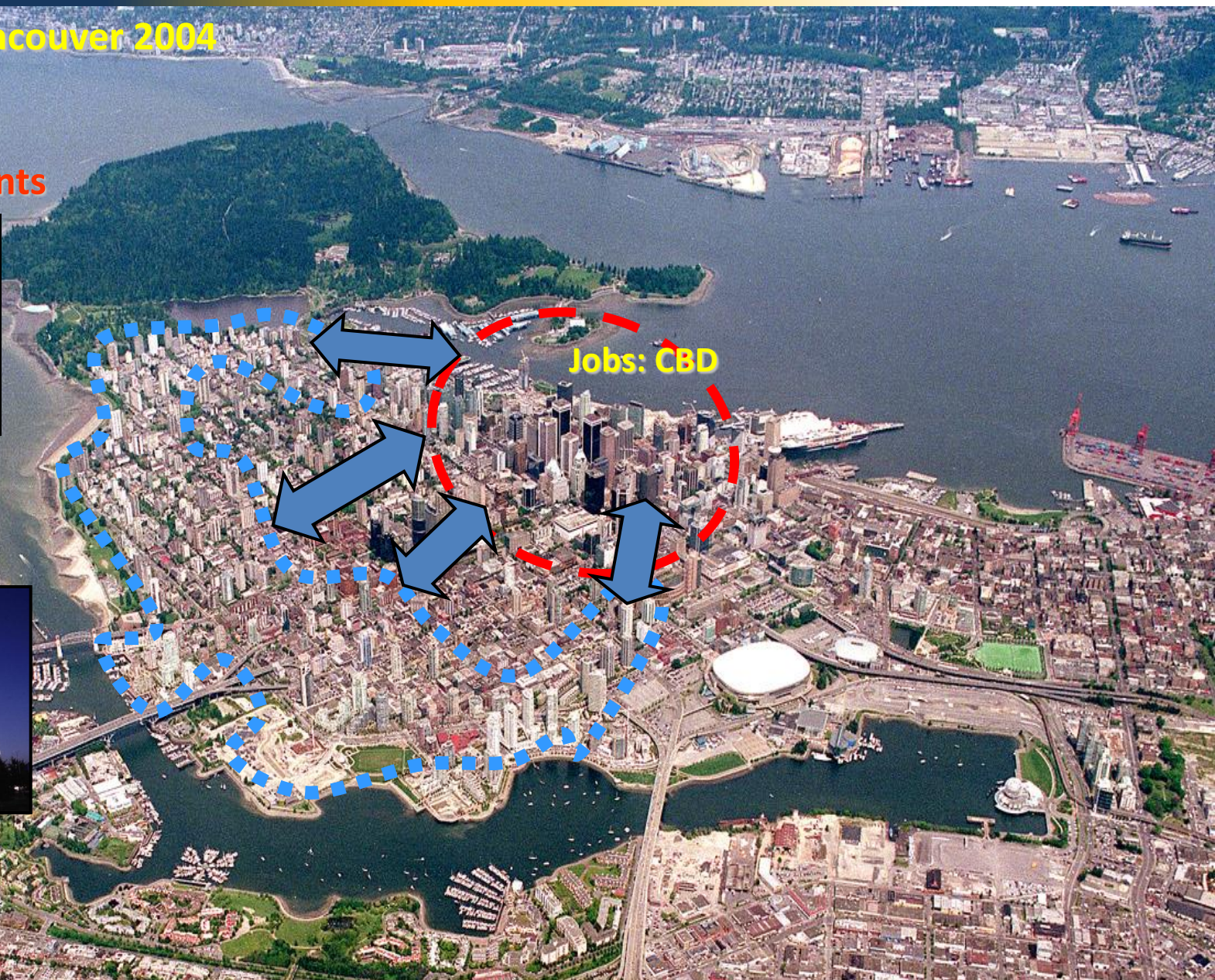
Downtown Vancouver 2004

140,000 jobs

100,000 residents



Housing Zone



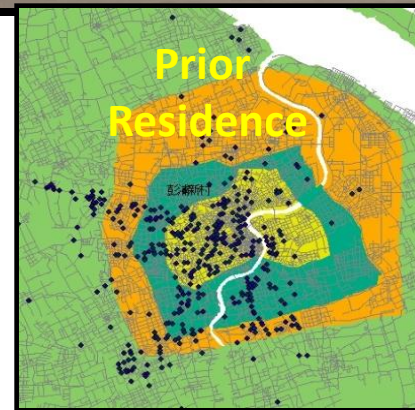
VKT/capita of Core Residents ~ 40% regional average

China's Urban Transformation

Compact, Mixed Uses,
Bike/Ped Friendly

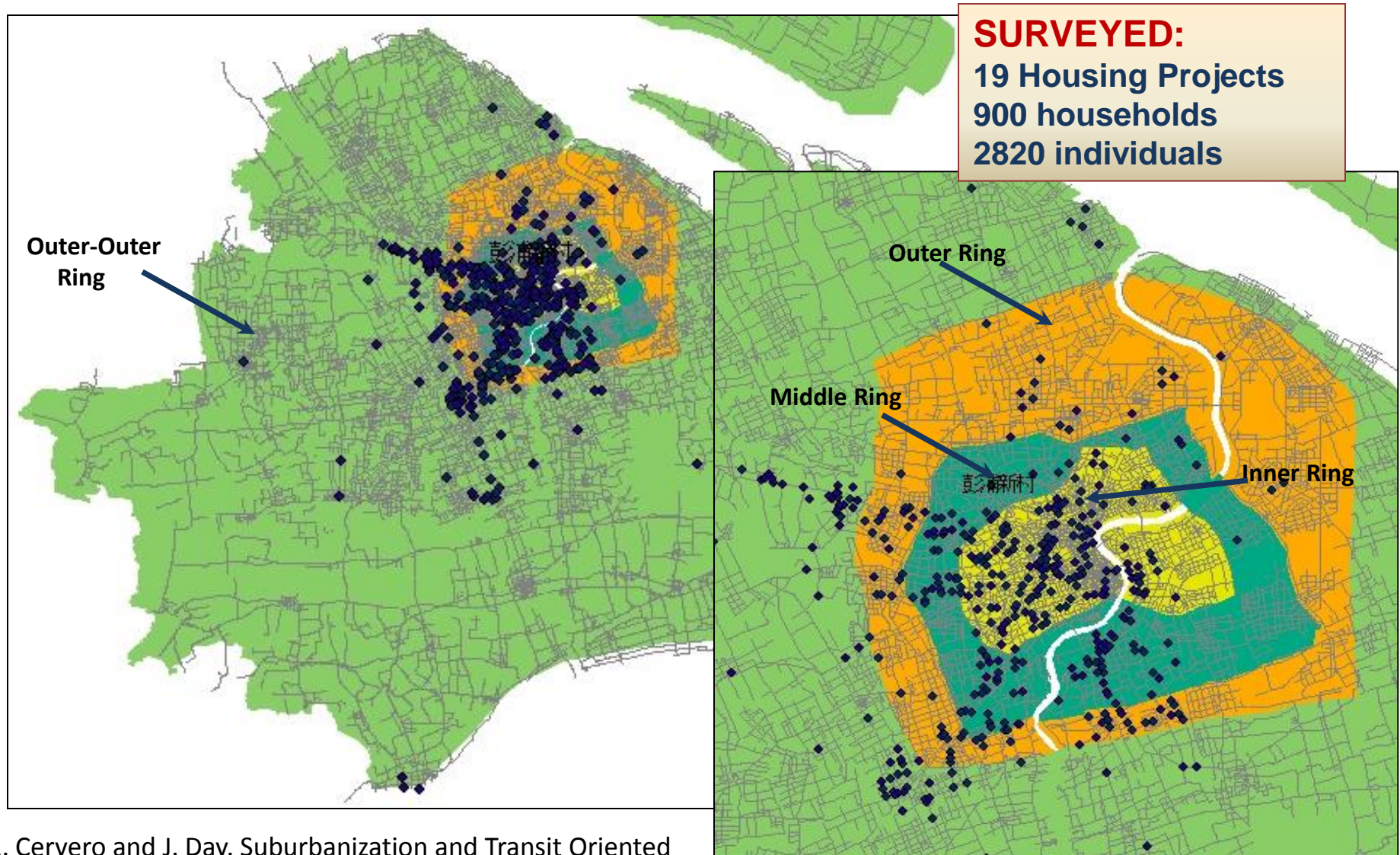


Isolated, Gated Superblocks
in Suburbs:



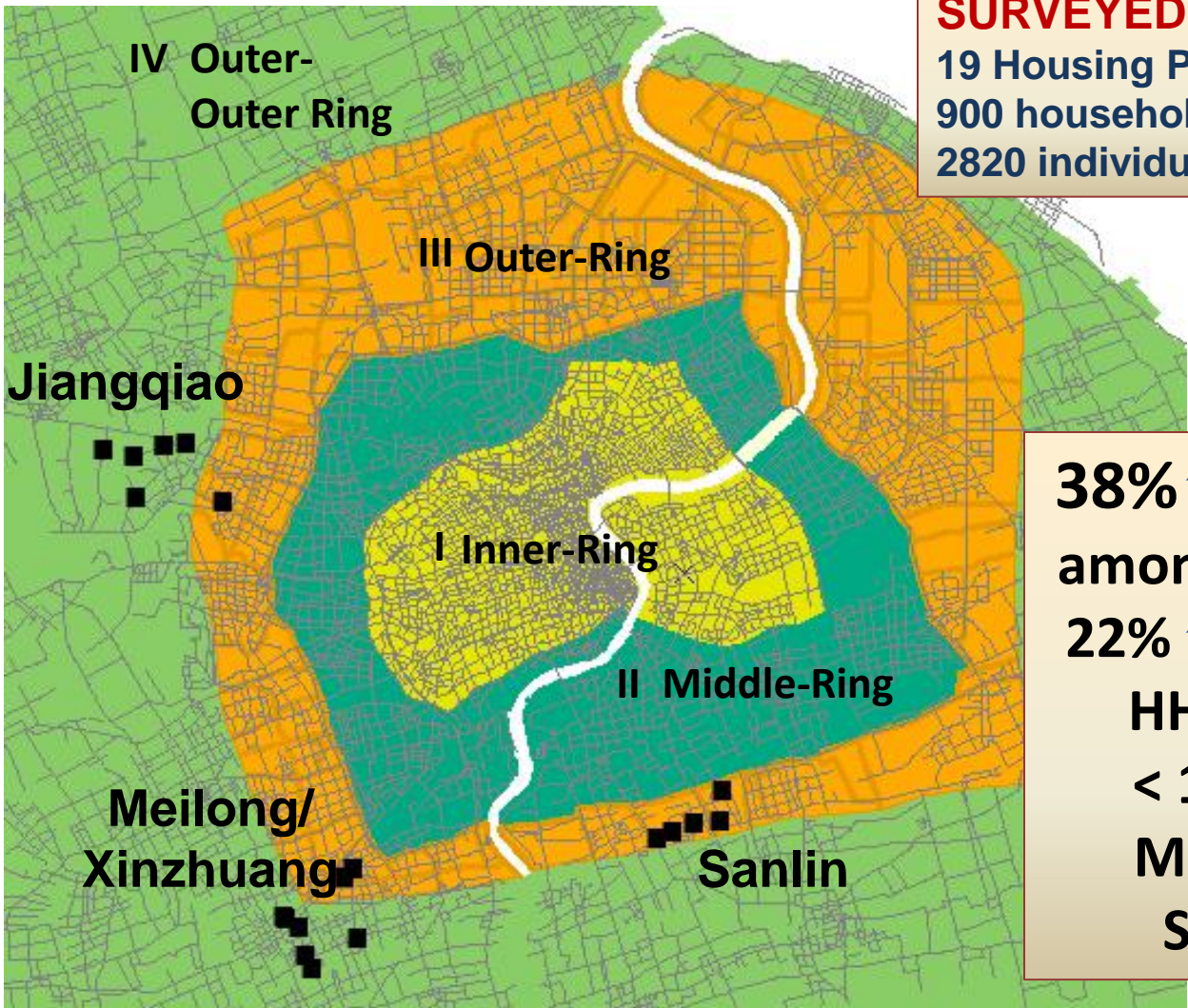
2008 Study: Suburban Relocation & Travel in Shanghai

Previous residences (2002-2004)



2008 Study: Suburban Relocation & Travel in Shanghai

Current Residences (2005-2007)

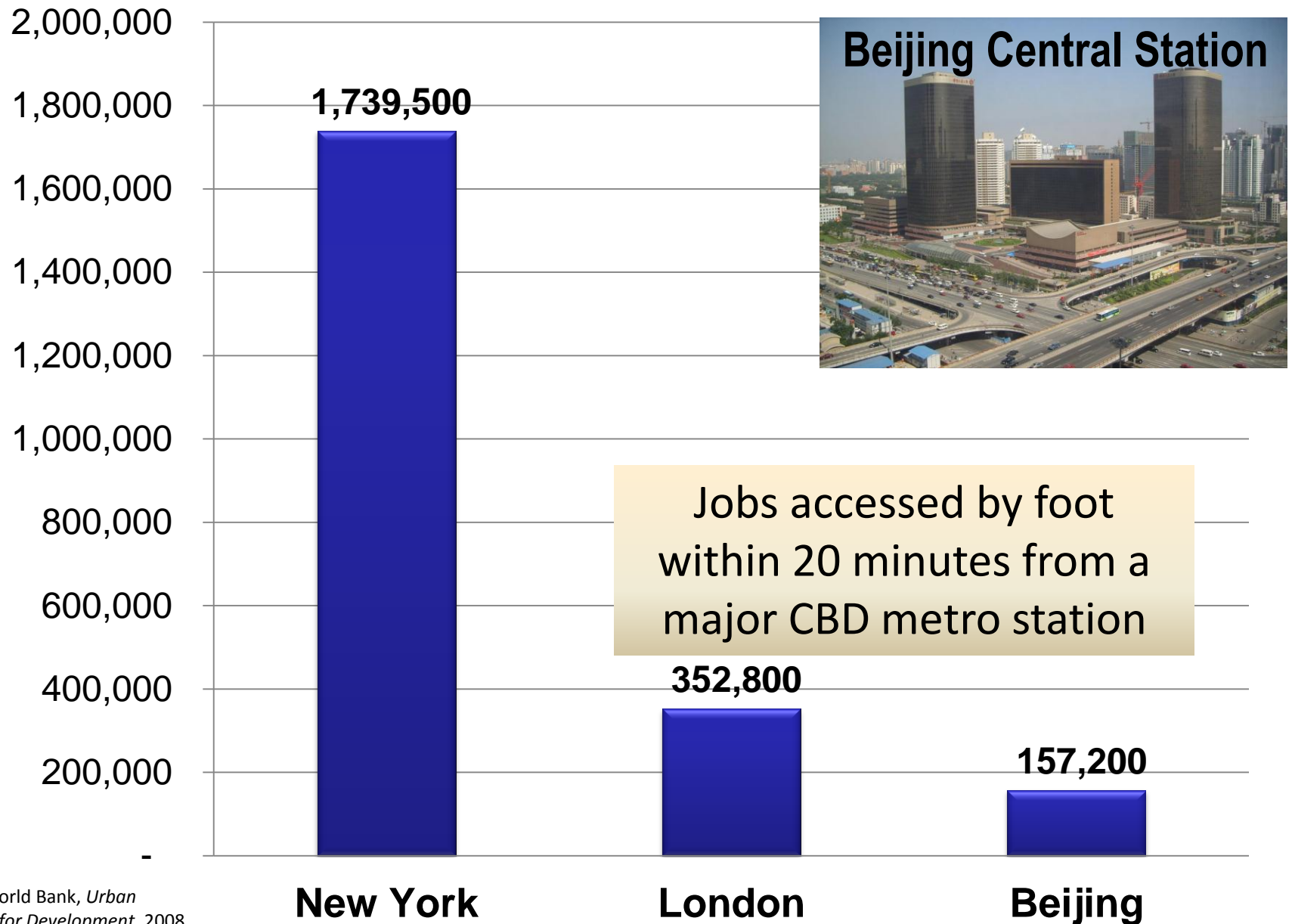


SURVEYED:
19 Housing Projects
900 households
2820 individuals

38% ↑ in VKT among movers;
22% ↑ among HHs living < 1 KM of Metrorail Station

R. Cervero and J. Day. Suburbanization and Transit Oriented Development in China, *Transport Policy*, Vol. 15, 2008, pp. 315-323.

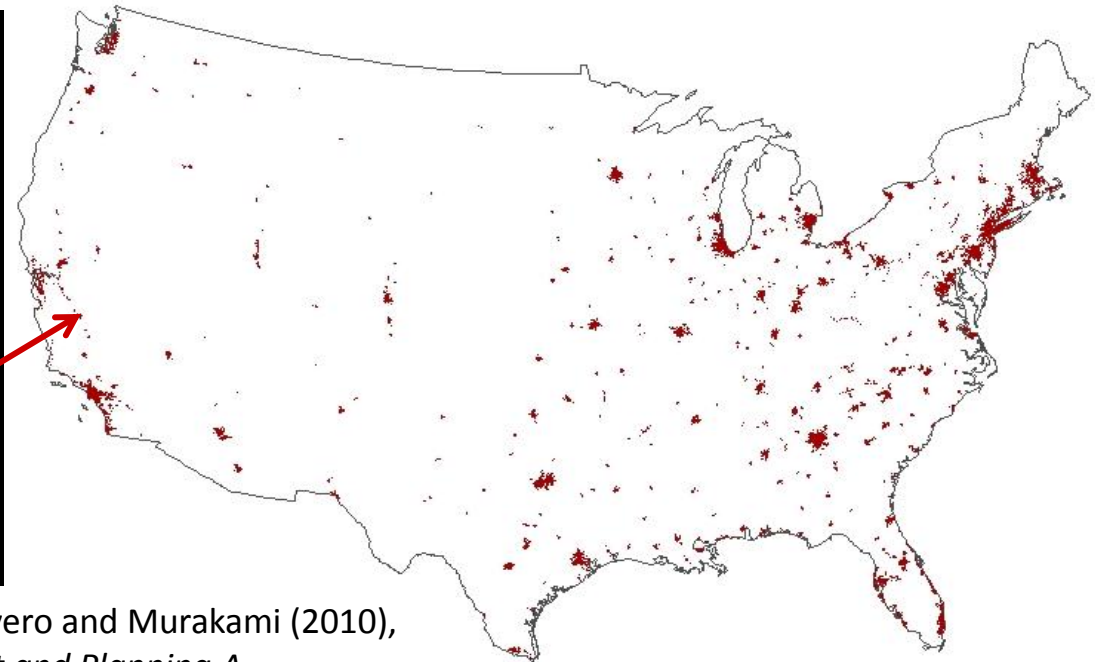
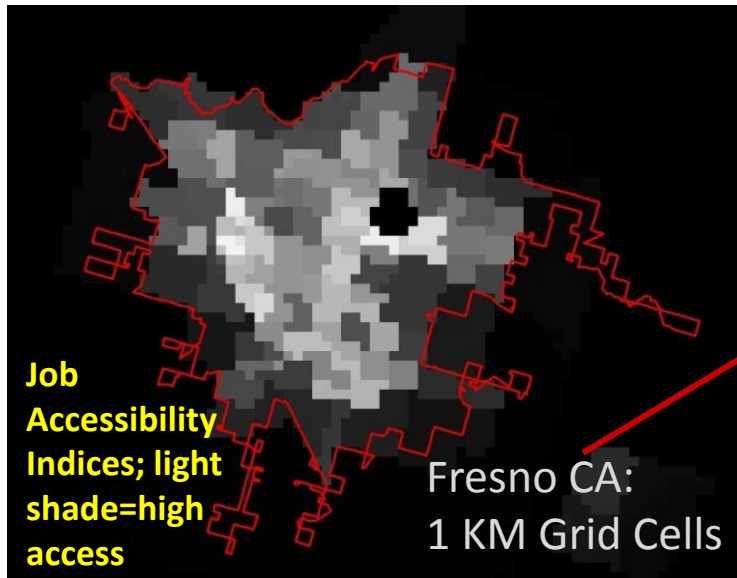
Urban Design & Pedestrian Access to Metros



Study of VMT & Carbon Footprint across 370 U.S. Metropolitan Areas, 1990-2004

$$\text{GHG Emissions} = \underbrace{\left[\frac{\text{Gallons}}{\text{Mile}} \right]}_{\text{Fuel Consumption}} \times \underbrace{\left[\frac{\text{Carbon}}{\text{Gallon}} \right]}_{\text{Carbon Content}} \times \underbrace{\left[\text{Vehicle Miles Traveled} \right]}_{\text{Activity}}$$

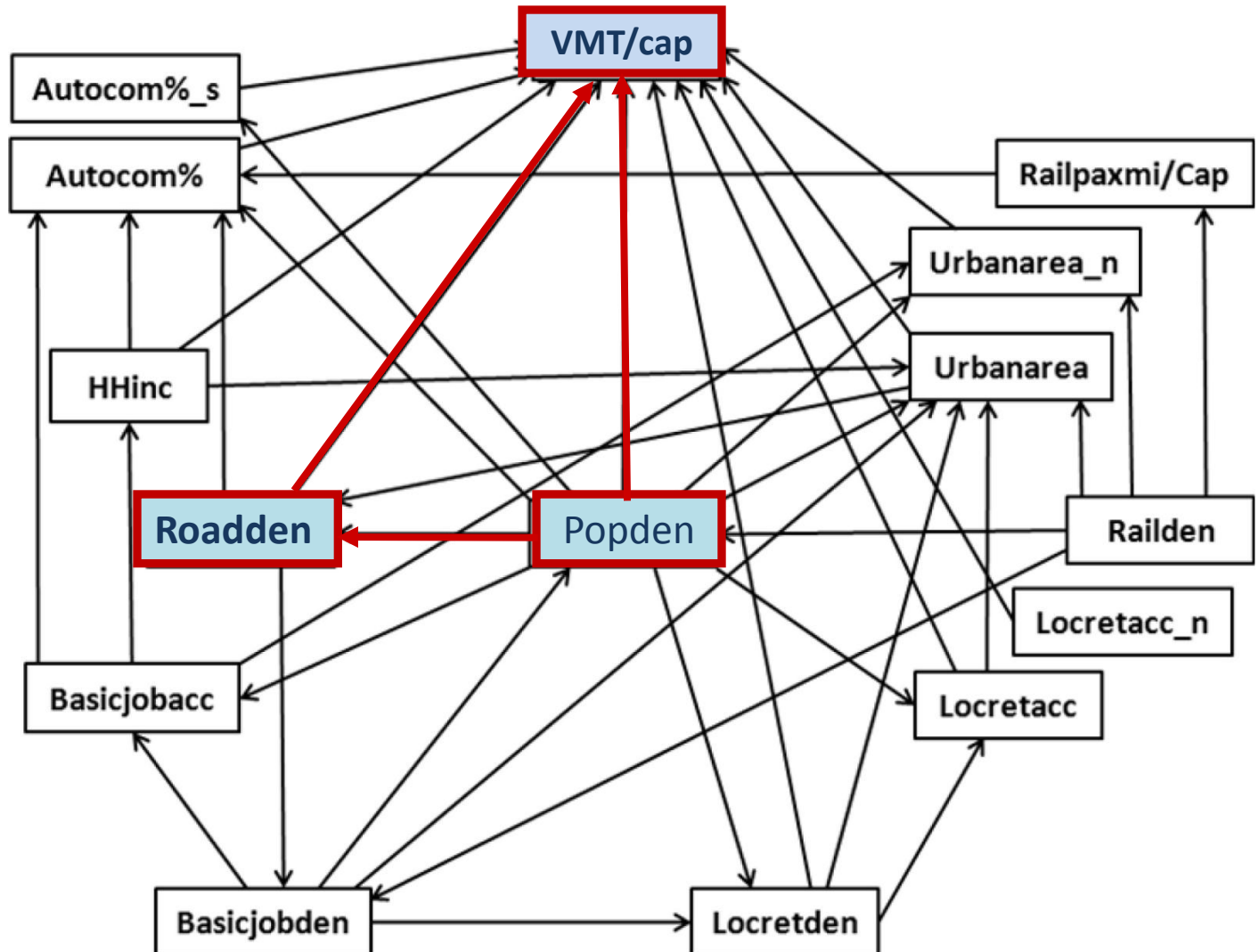
Sustainable Mobility Sustainable Urbanism



Source: Cervero and Murakami (2010),
Environment and Planning A.

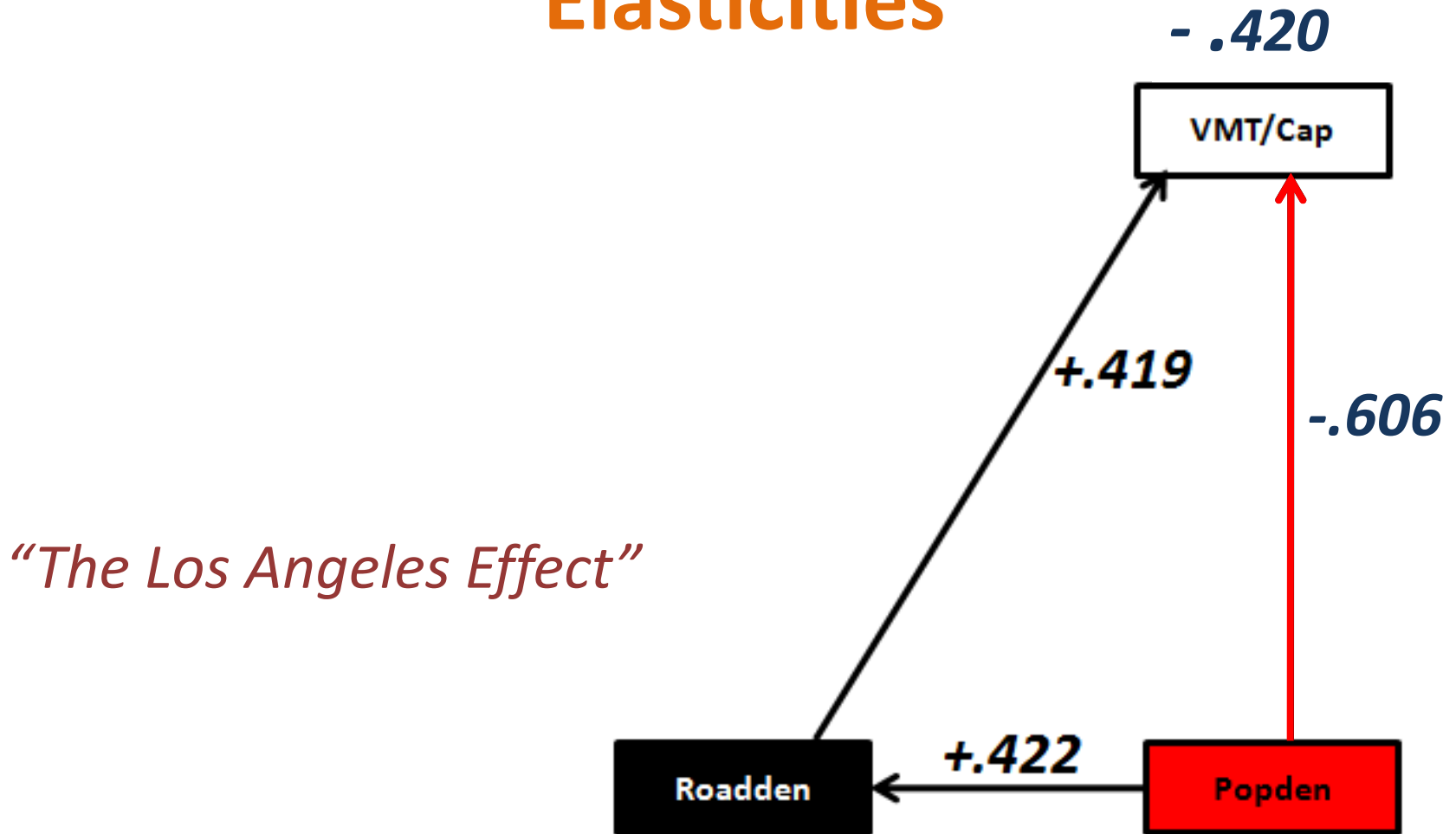
Density & VMT/Capita

Structural Equation Path Model

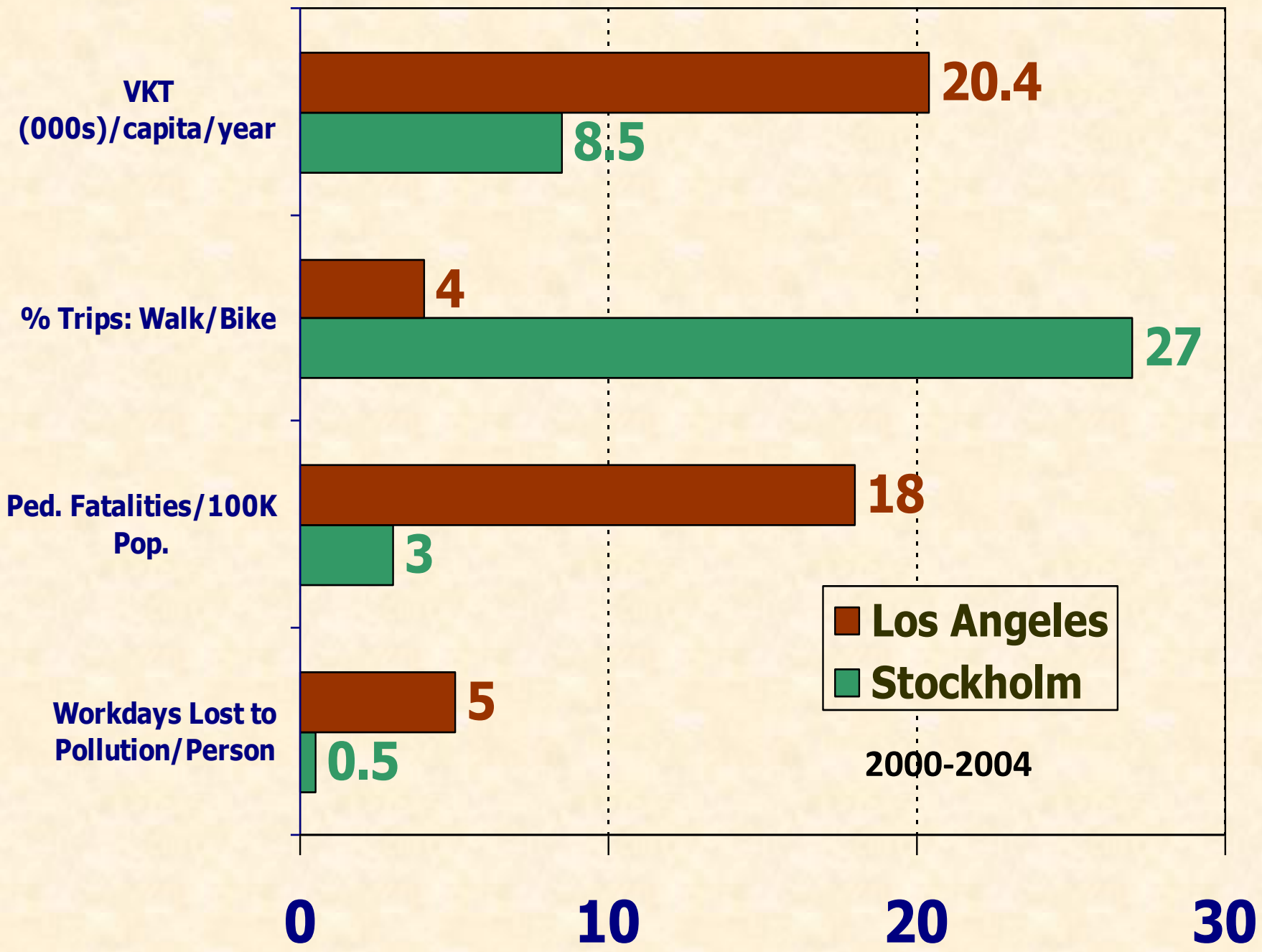


Density & Roads

Elasticities



Density's VMT-Reducing Impacts Moderated by Road Design ~ 1/3



Meta-Evidence on 4 Ds & Transit Use in US

Transit Ridership

Elasticities from Regressions & Logits

Dimension	Metric	# Studies	Elasticity
Density	Population Density	10	.07
	Job Density	6	.01
Diversity	Land Use Mix (0-1)	6	.12
Design	Intersections/Street Density	4	.23
	Connectivity (4-way inter.)	5	.21
Distance to Transit	Distance	3	.29

Source: R. Ewing & R. Cervero, Travel and the Built Environment: A Meta-Analysis, *Journal of the American Planning Association* 2010.

Elasticity = (% Δ Ridership) / (% Δ in "D" Variable)

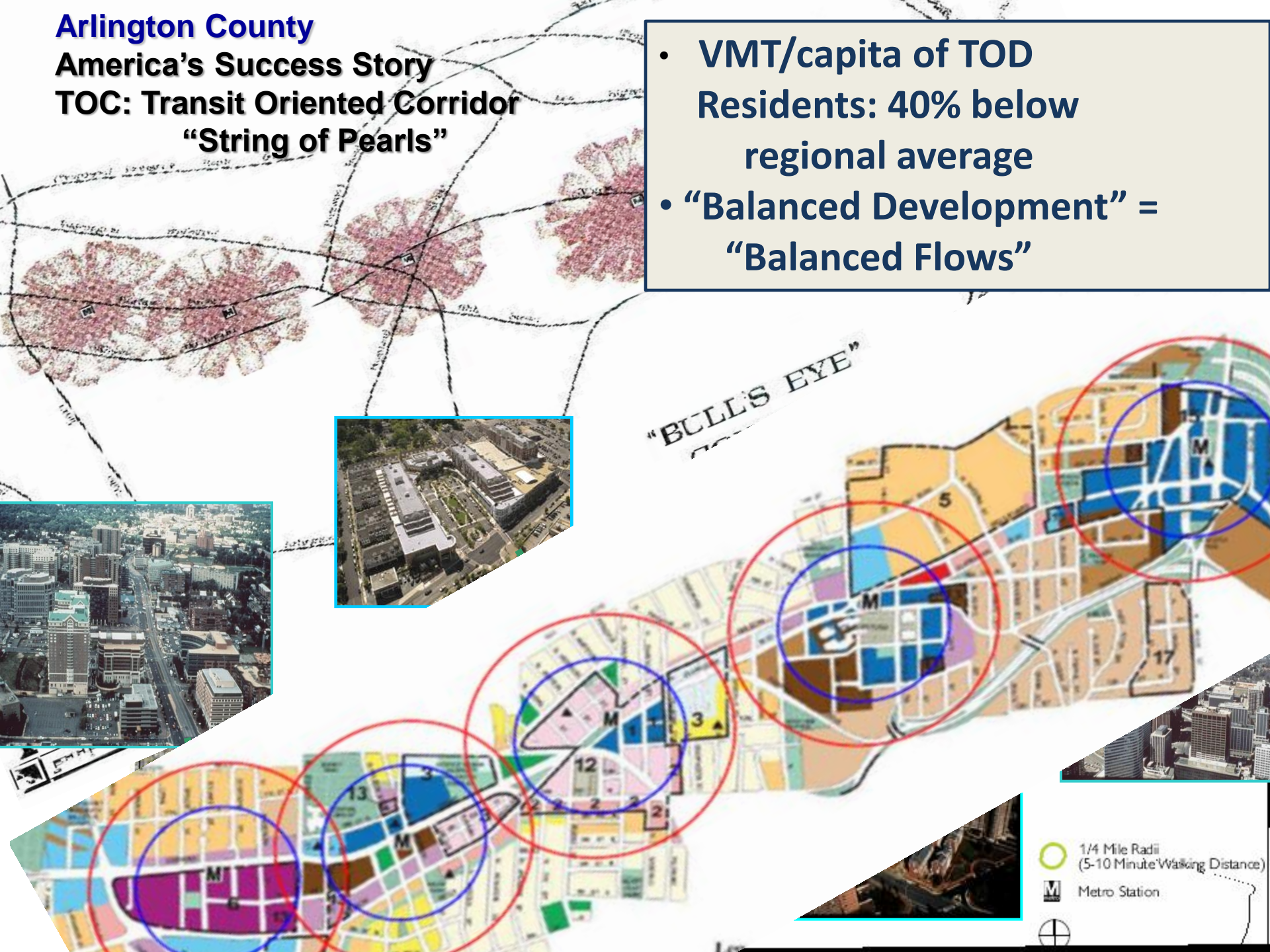
Arlington County

America's Success Story

TOC: Transit Oriented Corridor

"String of Pearls"

- VMT/capita of TOD Residents: 40% below regional average
- "Balanced Development" = "Balanced Flows"

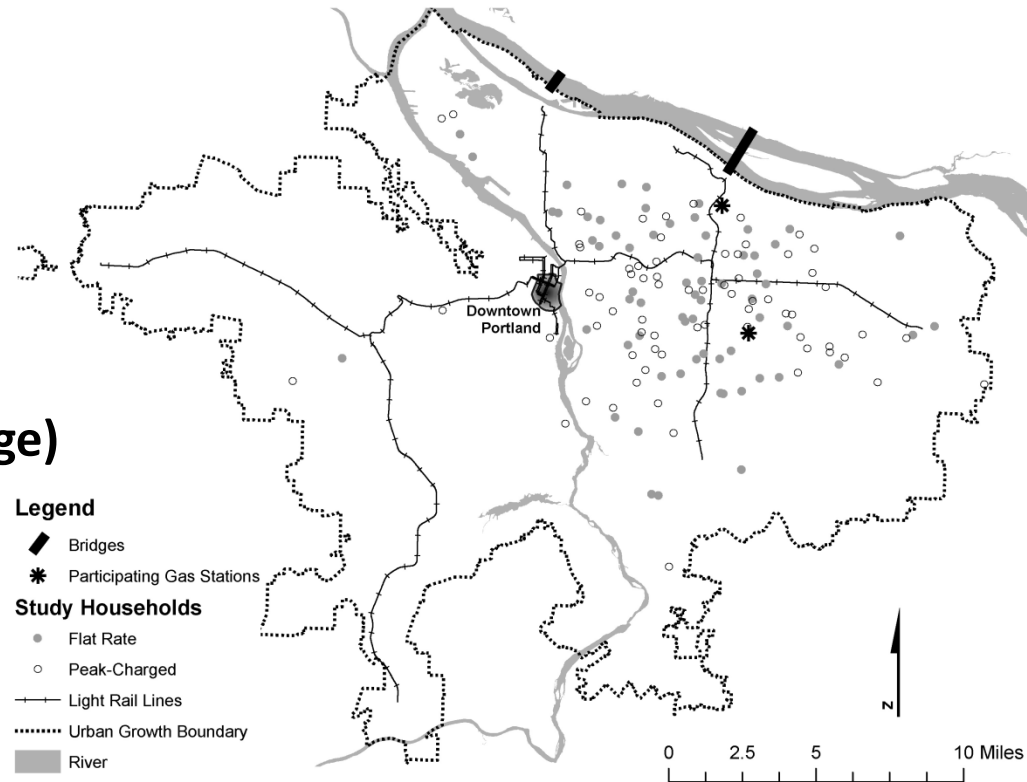


1/4 Mile Radii
(5-10 Minute Walking Distance)

M Metro Station

TOD & TDM

- 2006 Experiment of VMT Charge in Portland OR
- 183 HHs – some paid flat VMT rate; others paid rate that varied by time and location – **10¢/mile peak; 0.5¢/mile off-peak (congestion charge)**
- Found **greater VMT reduction in denser, mixed-use neighborhoods with congestion charges**



**Are Land Use Planning and Congestion Pricing Mutually Supportive?
Evidence From a Pilot Mileage Fee Program in Portland, OR**

Zhan Guo, Asha Weinstein Agrawal, and Jennifer Dill

Journal of the American Planning Association, Vol. 77, No. 3, Summer 2011

Urban Regeneration & BRT in Seoul, Korea



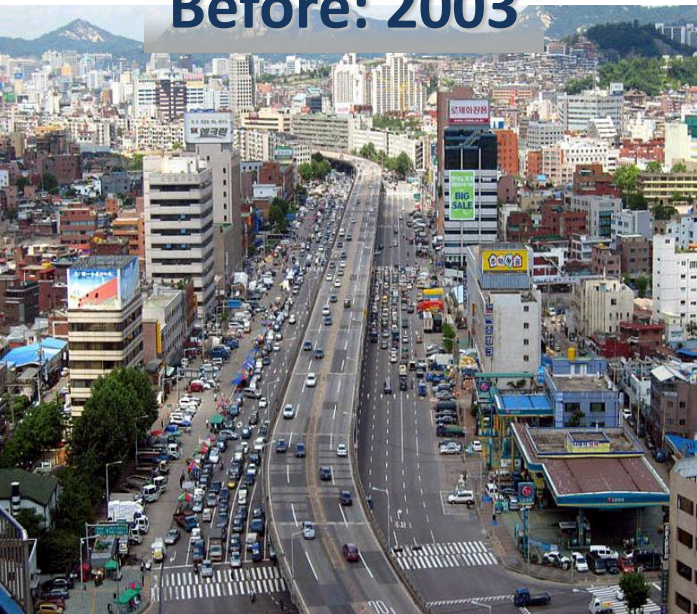
**M.B.
Lee**



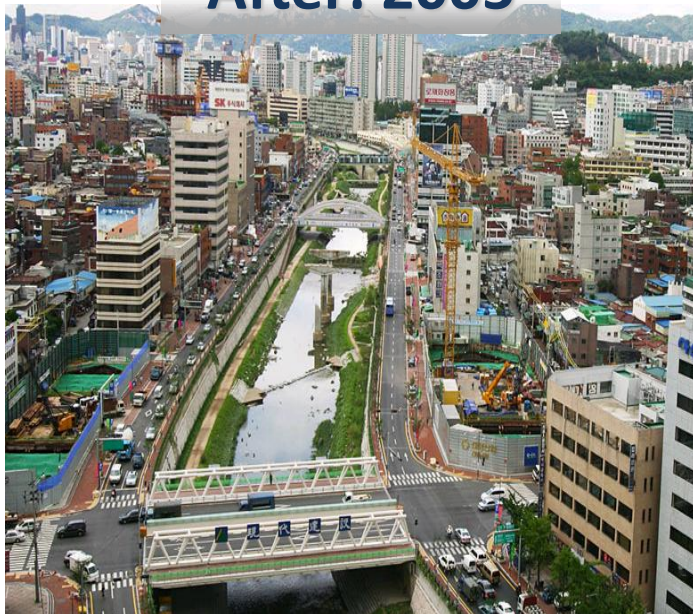
**Redesign of
Seoul Plaza
“Calmed”**

**Traffic with a
Pedestrian
Oval**

Before: 2003



After: 2005

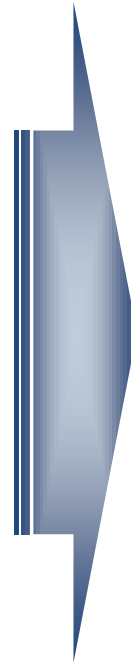


**Cheong Gye
Cheon**

**Freeway
Removal/
Stream
Restoration**

Seoul, Korea

BRT: Key to absorbing traffic displaced by road capacity losses

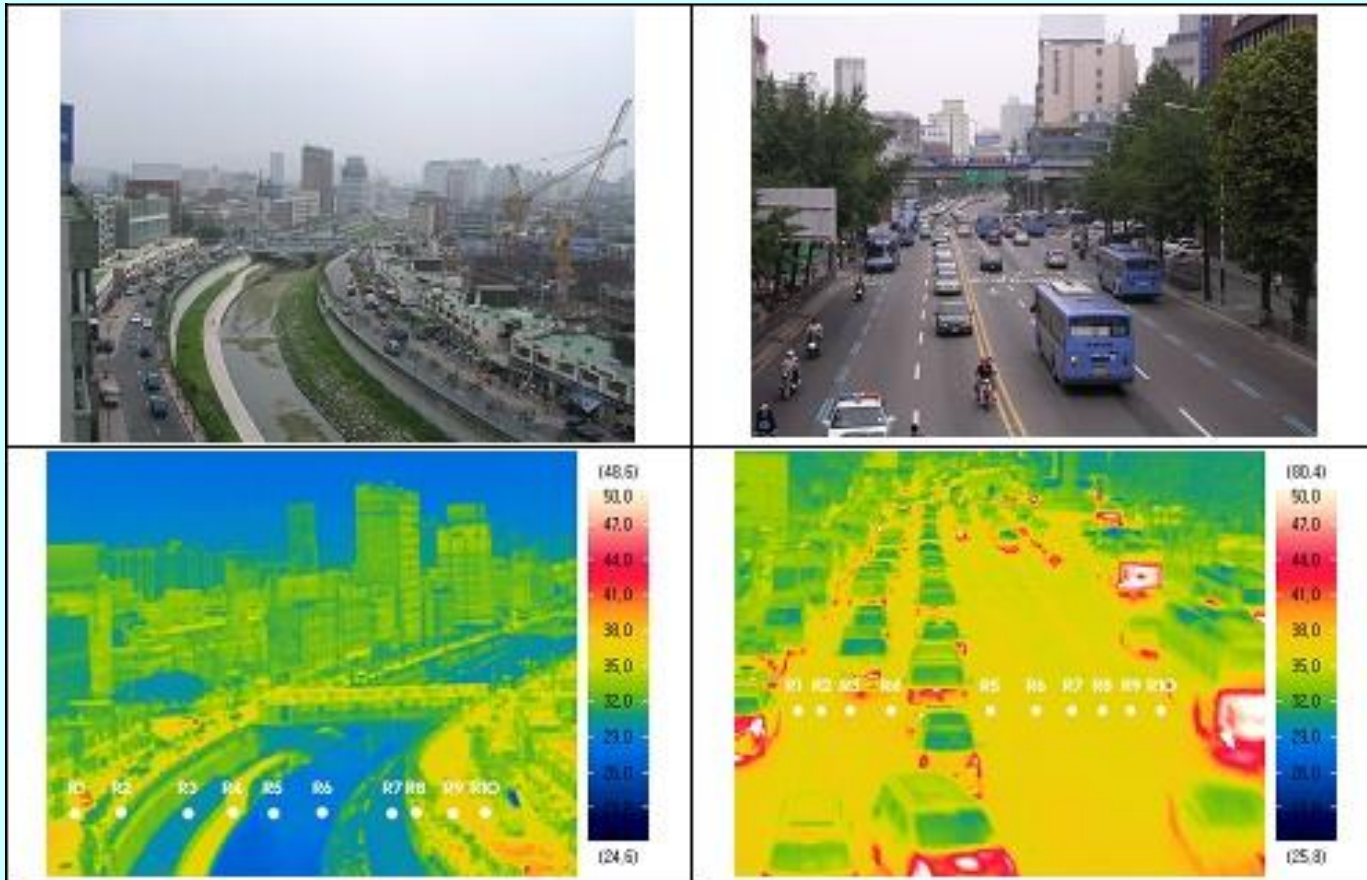


Exclusive median bus lanes: 7 lines/ 84 km

Curbside bus lanes: 293.6 km

■ Greening of Central Seoul

Thermal Intensity in CBD



Average Lowering of Temperature of 2%~5%

Asia BRT speed and demand comparison

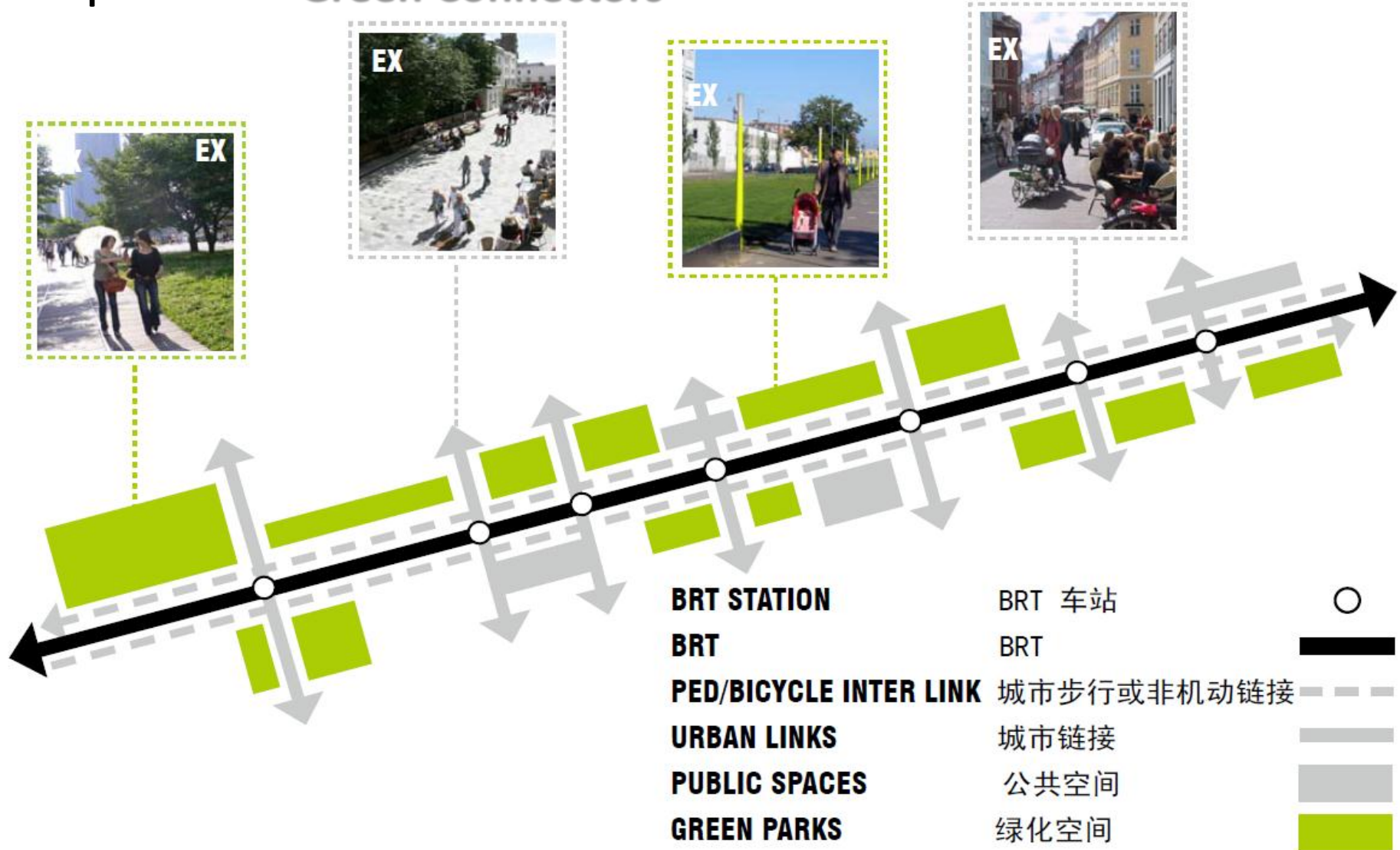


Figures refer to actual maximum passenger demand, not theoretical maximum capacity. Figures are from ITDP field surveys.

Source: itdp-china.org

Multi-modal (NMT) Integration was a conscientious part of system planning...NOT an Afterthought

Perpendicular **“Green Connectors”**



BRT STATION

BRT 车站



BRT

BRT



PED/BICYCLE INTER LINK

城市步行或非机动车链接



URBAN LINKS

城市链接



PUBLIC SPACES

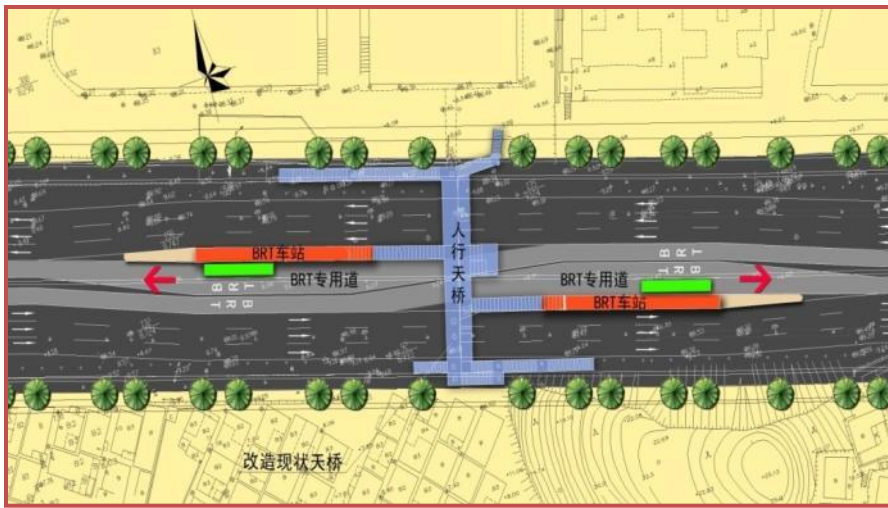
公共空间



GREEN PARKS

绿化空间





Seamless Pedestrian Connectivity through same-grade footbridges and BRT/Commercial Building integration



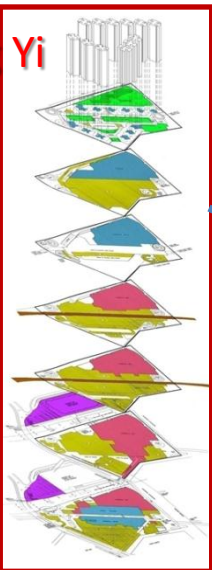


**Integration of BRT station bridge & building,
with double-tier bike parking under the bridge.**





Tsing Yi



Hong Kong's
"R+P" (Rail +
Property)

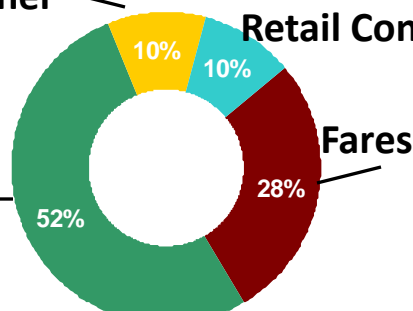


地鐵公司
MTR Corporation



● MTRC's property developments along rail line

Other — Retail Concessions



**MTR's
Revenue
Sources**

R. Cervero & J. Murakami,
Rail + Property Development in
Hong Kong, *Urban Studies*,
2009.

Place-making & Value

1980s-90s “Pre-Place-making” Station Access

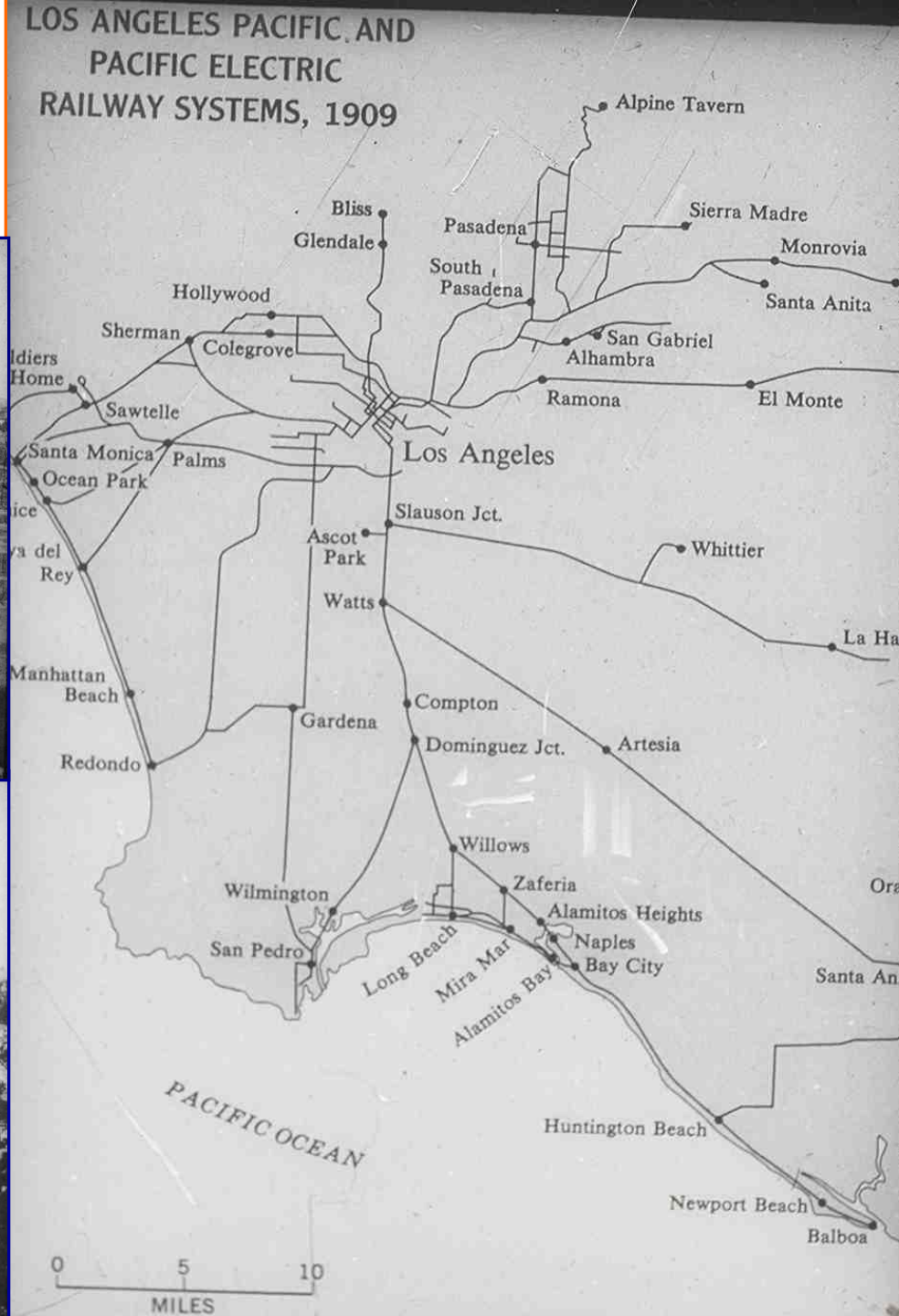
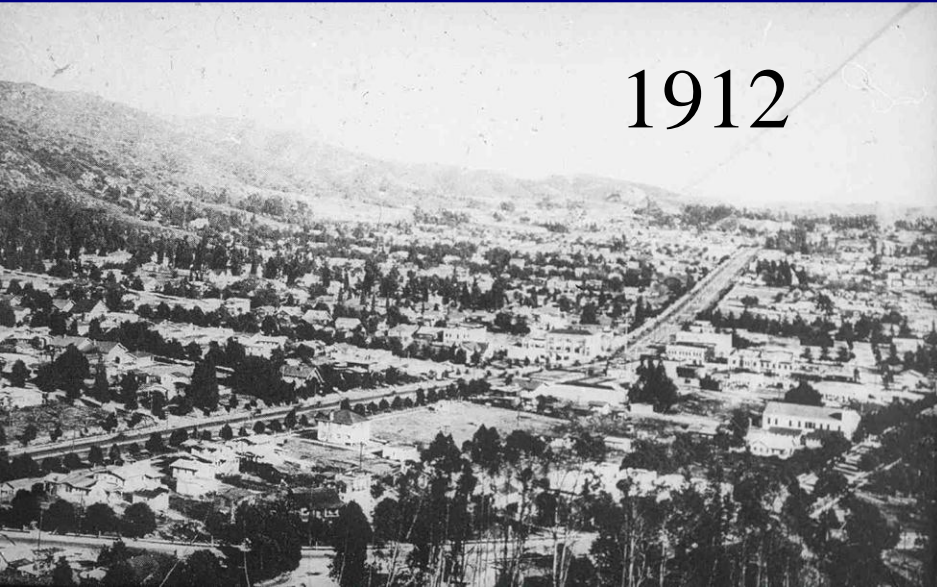
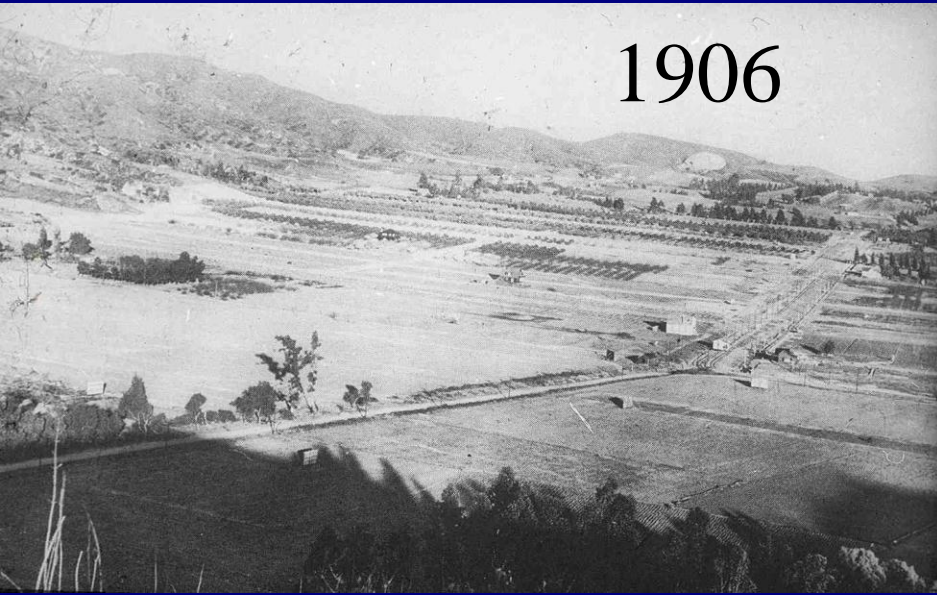


Post-2000s “Place-making” Station Access



**Ped-Friendly Access & Place-making Designs
Increased profits ~ 25%; Ridership Bonus ~ 20%**

Transit Value Capture in So. California



Back to the Future

